

Docket No.: HO-P02190US1
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Nicholas Thomas et al.

Application No.: 10/650,412

Confirmation No.: 6563

Filed: August 28, 2003

Art Unit: 1744

For: MICROFABRICATED APPARATUS FOR
CELL BASED ASSAYS

Examiner: Beisner, William H.

APPEAL BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

As required under § 41.37(a), this brief is filed within three months of the Notice of Appeal filed in this case on September 14, 2006, and is in furtherance of said Notice of Appeal.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1206:

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I. REAL PARTY IN INTEREST

The real party in interest for this appeal is Gyros Patent AB.

II. RELATED APPEALS, INTERFERENCES, AND JUDICIAL PROCEEDINGS

There are no other appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A Preliminary Amendment dated August 28, 2003 was filed concurrently with the present Application canceling claims 2-19. A Second Preliminary Amendment was filed on November 17, 2003 adding claims 20-52 and canceling claim 1. A first Office Action mailed March 21, 2005, rejected claims 20-40 and withdrew claims 41-52 from consideration as being drawn to a non-elected invention. In a Response filed by the Applicant on August 22, 2005, Applicants canceled claims 20 and 41-52, and amended claims 21-23, 25-26, 33-34, and 36. In a Second Office Action mailed November 2, 2005, claims 21-40 were rejected. Applicants filed a Response on February 28, 2006 with no claim amendments. A Final Office Action was mailed on May 17, 2006 finally rejecting claims 21-40. Applicants filed a Notice of Appeal on September 14, 2006. There are 20 claims pending in application.

A. Current Status of Claims

- 1. Claims canceled: 1-20 and 41-52**
- 2. Claims withdrawn from consideration but not canceled: 0**
- 3. Claims pending: 21-40**
- 4. Claims allowed: 0**
- 5. Claims rejected: 21-40**

B. Claims On Appeal

The claims on appeal are claims 21-40. Claims 22-24 and 33 stand or fall together in this Appeal. Claim 25 stands or falls independently in this Appeal. Claims 34 and 35 stand or fall together in this Appeal. Claims 36-38 stand or fall together in this Appeal. Claims 21, 26 and 29-32 stand or fall together in this Appeal. Claims 27 and 28 stand or fall together in this Appeal. Claim 39 stands or falls independently in this Appeal. Claim 40 stands or falls independently in this Appeal.

IV. STATUS OF AMENDMENTS

Applicant did not file an Amendment After Final Rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Paragraph numbers refer to the published application 20040058408 whereas page and line numbers refer to the original Specification as filed. The claimed subject matter is a microfabricated apparatus for performing cell growth and/or cell based assays in a liquid medium. [0005]; Pg. 2, lines 25-27. The apparatus comprises a base plate, a cover plate and an hydrophobic valve. [0006]-[0008]; Pg. 2, line 28- pg. 3, line 3; [0034]; Pg. 7, lines 17-24 and [0037]; Pg. 9, lines 8-18. The base plate has a plurality of microchannel elements that each comprises a cell growth chamber, an inlet and an outlet channel. [0006]; Pg. 2, lines 29-31. The cover plate is positioned over the base plate. [0007]; Pg. 3, lines 1-3. The hydrophobic valve is in at least one of the chambers or channels that is defined by position the cover plate over the base plate. [0034]; Pg. 7, lines 17-24. More specifically, the hydrophobic valve comprises a localized region of hydrophobicity within the chamber or channel. [0034]; Pg. 7, lines 17-24 and [0037]; Pg. 9, lines 8-18.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

- A. Whether Claims 22-25 and 33-38 were properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Sheppard, Jr et al (US 6,143, 247) in view of Mian et al. (US 6,319,469) and Cathey et al. (US 5,660,993).**
- B. Whether Claims 21, 26 and 29-32 were properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Sheppard, Jr et al (US 6,143, 247) in**

view of Mian et al. (US 6,319,469) and Cathey et al. (US 5,660,993) taken further in view of Chen et al. (US 5,800,778).

- C. Whether Claims 27 and 28 were properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Sheppard, Jr et al (US 6,143, 247) in view of Mian et al. (US 6,319,469), and Chen et al. (US 5,800,778) taken further in view of Wolfe et al. (US 5,190,879).
- D. Whether Claims 39 and 40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sheppard, Jr et al (US 6,143, 247) in view of Mian et al. (US 6,319,469), and Cathey et al. (US 5,660,993) taken further in view of Cook (WO9426413).

VII. ARGUMENT

- A. Rejection under 35 U.S.C. § 103(a) over Sheppard, Jr et al (US 6,143, 247) in view of Mian et al. (US 6,319,469) and Cathey et al. (US 5,660,993)

1. Claims 22-24 and 33

Because the references cited by the Patent Office fail to account for each and every element in a claim this rejection must be withdrawn. Claim 22 includes limitations to a cover plate and a hydrophobic valve. The Patent Office has not clearly identified either element in any of the cited prior art. Consequently, the Patent Office should be reversed.

a. *Graham* Factors: Scope and Contents of the Prior Art

Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), controls the consideration and determination of obviousness under 35 U.S.C. 103(a). The four factual inquiries enunciated therein as a background for determining obviousness are as follows:

- Determining the scope and contents of the prior art;
- Ascertaining the differences between the prior art and the claims in issue;
- Resolving the level of ordinary skill in the pertinent art; and
- Evaluating evidence of secondary considerations.

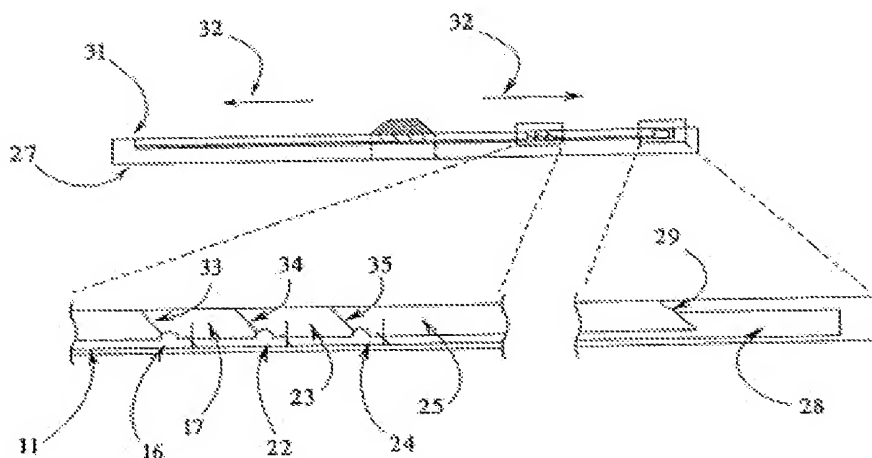
i. Sheppard et al. & Mian et al.

The Patent Office has not identified or otherwise accounted for the presence of a cover plate or hydrophobic valve elements in either Sheppard or Mian. The Patent Office

does not allege that the hydrophobic valve element is disclosed by either Sheppard or Mian. Applicant asserts that the hydrophobic valve element is neither taught nor suggested within either Sheppard or Mian.

Regarding the cover plate, the Patent Office cites Figure 1B of Mian for the cover plate limitation of claim 22. Final Office Action 05/17/06, pg. 3. Mian does not describe the contents of Figure 1B beyond the following:

FIGS. 1A (top view) and 1B (side view) illustrate the arrangement of reservoirs (12,14,18,20), valves (13,15,17,19,21,23,25) reaction chambers (16,22,24), ports (11,32) and air vents (29,33,34,35) in disks comprising the microplatforms of the invention. FIG. 1C shows the arrangement of a multiplicity of microsystems on a disk.



The Patent Office provides no guidance on how Figure 1B supplies the cover plate limitation. Applicant asserts that Figure 1B shows a contiguous microfluidic structure with air vent 29 creating the superficial appearance of a two piece device in the cross sectional image. The Patent Office does not contend that any other disclosure of record supplies the cover plate element. Because the Patent Office has not accounted for the cover plate limitation in claim 22, the Patent Office rejection is invalid and should be reversed. MPEP §§ 2141.02 & 2143.03; 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

In addition, the Patent Office characterizes the capillary valves disclosed by Sheppard & Mian thusly:

The list of disclosed valves includes capillary microvalves wherein the fluid flow is stopped based on the geometry of the channel and surface properties of the substrate material and fluid.

Final Office Action 05/17/06, pg. 4. The Patent Office's summary of the capillary valves of Shepard could be read as implying some degree of structural overlap between the claimed hydrophobic valves and the disclosed capillary valves. To be clear, the surface properties of the substrate material of the Sheppard capillary valves are homogenous:

Fluids which completely or partially wet the material of the microchannels, reservoirs, detection chambers, etc. (i.e., the components) of the platforms of the invention which contain them experience a resistance to flow when moving from a component of narrow cross-section to one of larger cross-section, while those fluids which do not wet these materials resist flowing from components of the platforms of the invention of large cross-section to those with smaller cross-section.

Sheppard, col. 20, ln. 35-43. The capillary valves in Sheppard & Mian are structurally and mechanistically unrelated to the claimed hydrophobic valves. Thus, the Patent Office has not identified either the cover plate or hydrophobic valve elements of claim 22 within Sheppard & Mian.

ii. Cathey et al.

The Patent Office does not cite Cathy as supplying the cover plate element of claim 22. The Patent Office cites Cathey as supplying only the hydrophobic valve element. Final Office Action 05/17/06, pg. 4. Applicant contends the Patent Office is incorrect. Mirroring the issues with Sheppard & Mian above, Applicant asserts that the cited portion of Cathey does not supply the hydrophobic valve element. Cathey discloses two aspects of fluid flow control through the Cathey device, rate control where flow is enhanced or slowed by means of the degree of hydrophilicity/hydrophobicity and valving by capillary valves where fluid flow is stopped. Col. 5, ln. 46-60. Another possible interpretation is that hydrophobic areas

combined with hydrophilic areas may be employed to direct fluid flow. *Id.* The Cathey disclosure uses only capillary valving in its embodiments and does not disclose hydrophobic valves in any figures or working examples. *E.g.* col. 11, ln. 30-31. Thus, the Patent Office has not identified either the cover plate or hydrophobic valve elements within Cathey or Sheppard & Mian. Because the Patent Office has not accounted for the cover plate limitation or the hydrophobic valve limitation in claim 22, the Patent Office rejection is invalid and should be reversed. MPEP §§ 2141.02 & 2143.03; 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

b. *Graham* Factors: Ascertaining the differences between the prior art and the claims in issue

i. Sheppard et al. & Mian et al.

Sheppard and Mian disclose microfluidic devices, some of which are designed for live cell retention and growth within specialized chambers. The Patent Office does not rely upon Sheppard & Mian to supply the hydrophobic valve element. The cited Figure 1B in Mian relied upon by the Patent Office does not supply the cover plate element as discussed above.

In addition, Sheppard and Mian disclose different means for valving of fluid movement, namely piezo-electric actuator valves, pneumatically actuated valves, pressure balanced valves, gas valves, polymeric relaxation valves and capillary junction valves. Sheppard, col. 20, ln. 13-67; Mian, col. 17 ln. 38 – col. 19, ln. 63. Nowhere does either Sheppard or Mian disclose valving by way of the claimed hydrophobic valves. This despite the disclosure of Sheppard and Mian of how to treat various materials' surfaces to derive a hydrophobic surface. Mian, col. 14, ln. – col. 15, ln. 45. Applicant presumes the inventors for the Sheppard and Mian disclosures were at least of ordinary skill in the relevant art(s). Mian is the more general disclosure of microfluidic devices. The use of regions of hydrophobic surfaces functioning as flow valves was evidently not an obvious alternative to these inventors, even in the broader Mian disclosure. Despite the absence of hydrophobic valves from the Sheppard & Mian laundry list disclosure of alternatives, the Patent Office retrospectively deems modifying Sheppard & Mian to include a hydrophobic valve as obvious. Applicant asserts that this is classic hindsight reconstruction and should be reversed.

With regard to the primary reference, Sheppard, the disclosure not only fails to appreciate the possibility of hydrophobic valves, but also teaches against using hydrophobic surfaces as valves. Sheppard discloses the knowledge that hydrophobic surfaces nonspecifically adsorb proteins and cells. Col. 16, ln. 9-12; col. 17, ln. 26-30. Shepard further teaches that the surfaces of a particular microfluidic device should be designed with the application in mind. Col. 15, ln. 57-60; col. 16, ln. 9-12. Based on the teachings of Sheppard, hydrophobic regions would plausibly be employed to help anchor cells, ligands proteins, or materials within growth chambers. Col. 16, ln. 15-29. However, even in this aspect Sheppard is concerned by subsequent non-specific adsorption and recommends blocking non-specific binding with BSA or other materials. Col. 17, ln. 20-54. In view of Sheppard's teachings on cell and protein adsorption to hydrophobic surfaces, use of such surfaces, other than for the purpose of promoting sample material adsorption, would run contrary to the teachings in Sheppard and the intended purposes of the Sheppard devices to process cell and protein containing samples. Because Sheppard teaches against the Patent Office's modification, the Patent Office should be reversed.

ii. Cathey et al.

As discussed above, Cathey discusses capillary valving in its embodiments and does not use hydrophobic valves. *E.g.* col. 11, ln. 30-31. Applicant asserts that Cathy does not disclose the hydrophobic valves of the instant claims. The capillary valves actually used by Cathy are unrelated in structure or mechanism of function to the claimed hydrophobic valves. Applicant contends that the Patent Office rejection represents an impermissible hindsight reconstruction of the claimed subject matter. As a result, the Patent Office erroneously reads into the prior art the hydrophobic valve element. *Graham v. John Deere*, 383 U.S. 1, 36 (1966) (Observing that one must guard against "slipping into use of hindsight" and reading the claimed subject matter into the prior art.); *In re Shuman*, 361 F.2d 1008, 1012 (CCPA 1964) ("It is impermissible to first ascertain factually what appellants did and then view the prior art in such a manner as to select from the random facts of that art only those which may be modified and then utilized to reconstruct appellants' invention from such prior art."). The Patent Office thus lacks substantial evidence to support the conclusion that the claimed subject matter is obvious. Because the Patent Office rejection constitutes an arbitrary and

capricious decision and is lacking substantial evidence in support, the Patent Office should be reversed. 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

c. Teaching, Suggestion, or Motivation to Combine or Modify the Art

To establish *prima facie* obviousness the Patent Office must identify and explain the reasons why one of ordinary skill in the art would derive the claimed subject matter. *Dystar Textilfarben GmbH v. C.H. Patrick Co.*, 2006 U.S. App. LEXIS 24642 at *10, *28-*31 (Fed. Cir. Oct. 3, 2006). *In re Lee*, 277 F.3d 1338, 1341, 1344-45 (Fed. Cir. 2002).

i. Modifying Sheppard et al. Plus Mian et al. by Reference to Cathey et al.

The Patent Office rejection is based upon the false conclusions that the cover plate element has been identified in Sheppard & Mian and that Cathey supplies the hydrophobic valve element. Because the Patent Office has failed to identify all elements, it is impossible for the Patent Office to articulate a valid motivation to combine these unaccounted for elements.

(1) Art recognized Equivalency

Even if it assumed that Cathey discloses hydrophobic valves. Applicant asserts that Cathy does not support the position that the art, recognized hydrophobic valves as equivalents to capillary valves. MPEP § 2144.06. The caselaw on this subject is consistent. Evidence of equivalency was found in the prior art in the form of reduction to practice of the two equivalents in what were the same or very similar circumstances. *In re Fout*, 675 F.2d 297, 301 (CCPA 1982); *In re Siebentritt*, 372 F.2d 566 (1967); *Smith v. Hayashi*, 209 USPQ 754, 759 (Bd. of Pat. Inter. 1980). Thus, it was reasoned, one of skill in the art, aware of the prior art, would understand from these teachings that these were substitutable equivalents in the context of the particular environment at issue. Cathy makes no such disclosure of a reduction to practice of hydrophobic valves. Rather Cathy exclusively employs capillary valves. *E.g.* Fig. 4 and col. 12, ln 13-32. Cathy does not reference other prior art that actually uses hydrophobic valves. Cathey does not even characterize hydrophobic areas as a “typical” valve structure or otherwise indicate in general terms that hydrophobic valving was well

known in the art. Applicant asserts that it cannot be *prima facie* obvious to substitute structurally and mechanistically different means for valving without some evidence of successful reduction to practice of both means in a relevant context. The Patent Office cites no such evidence and the limited statement in Cathey does not suffice as such.

(2) Teaching Away

The art must be viewed and assessed as a whole for what it teaches and suggests. MPEP § 2141.02. Prior art suggesting and prior art teaching away from a claimed invention must be weighed to determine in the aggregate whether the prior art fairly suggests the claimed subject matter. MPEP § 2141.03(II). The Patent Office rejection is incorrectly premised upon one of skill in the art substituting the hydrophobic valve allegedly disclosed by Cathey for the various other valving means disclosed by Sheppard & Mian. Applicant further asserts that the teachings of Sheppard & Mian direct one of skill in the art away from the Patent Office's advanced modification. As discussed above for the *Graham* factor analysis, Sheppard & Mian clearly teach that cells and proteins non-specifically adsorb to hydrophobic surfaces. Modifying Sheppard to use hydrophobic valves would run contrary to the specific teachings of Sheppard & Mian in the context of devices intended for use with protein &/or cell containing samples. This specific teaching must carry the greater weight over any general teaching Cathey may be (erroneously) alleged to disclose. The specific teachings in Sheppard & Mian result in no motivation to modify Sheppard & Mian in the way the Patent Office advances but rather a motivation not to make the proposed modification. Thus, the Patent Office rejection is invalid and should be reversed. MPEP §§ 2141.02 & 2143.03; 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

(3) Suitability for Intended Purpose

Alternatively, the teachings of Sheppard & Mian teach that hydrophobic surfaces are not suitable for handling samples with proteinaceous or cellular components where those components are the ones being analyzed (*e.g.* measuring numbers of a cell type per unit volume). The Patent Office's proposed modification would yield an unsuitable embodiment of the Sheppard device and thus cannot be used to make out a *prima facie* case of obviousness. MPEP § 2143.01(V.).

2. Claim 25

The Patent Office rejection for the additional limitation in claim 25 is in its entirety:

With respect to claim 25, the device suggested by the combination of the references of Sheppard, Jr. et al. and Mian et al. would be a rotatable disc with a center inlet port and annular sample chamber.

Final Office Action 05/17/06, pg. 5. The Patent Office rejection is facially inadequate. MPEP § 706.02(j). Procedural impropriety aside, Applicant asserts that Sheppard & Mian do not disclose or suggest an annular sample chamber. Sheppard Fig. 2; Mian, col. 26, ln. 8-33, Fig. 13C. The Patent Office is therefore in error at least with regard to the scope and content analysis required under *Graham*. The pending Patent Office thus lacks substantial evidence to support the conclusion that the claimed subject matter is obvious. Because the Patent Office rejection against the claims constitutes an arbitrary and capricious decision and is lacking substantial evidence in support, the Patent Office should be reversed. 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

3. Claims 34-35

The pending Patent Office for the additional limitations in claims 34-35 is:

With respect to the use of inlet channels of one size verses an outlet of a smaller size of claims 34 and 35, the reference of Mian et al. discloses that it is known in the art to control the flow of liquid through a plurality of zones using changes in cross-sectional area between the zones (See column 19, lines 25-63).

Final Office Action 05/17/06, pg. 5. The Patent Office is in error at least with regard to the scope and content analysis required under *Graham*. The cited portion of Mian discloses capillary valves for stopping flow until a threshold driving force is applied to the fluid. This passage has nothing to do with the limitations in claims 34-35 structurally or functionally. The Patent Office thus lacks substantial evidence to support the conclusion that the claimed subject matter is obvious. Because the Patent Office rejection constitutes an

arbitrary and capricious decision and is lacking substantial evidence in support, the Patent Office should be reversed. 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

4. Claims 36-38

The Patent Office rejections against claims 36-38 are composed of a) an admission that the art does not contain the elements and 2) a conclusory assertion that the limitations would be obvious in light of the totality of Mian & Sheppard. Final Office Action 05/17/06, pg. 5. The Patent Office rejection is facially inadequate and addresses none of the *Graham* factors. MPEP § 706.02(j). To the degree Applicant can make out the Patent Office's reasoning, it appears to be an irrelevant assertion that the additional limitations are within the skill in the art. MPEP § 2143.01(IV.). The pending Patent Office rejection thus lacks substantial evidence to support the conclusion that the claimed subject matter is obvious. Because the Patent Office rejection against the claims constitutes an arbitrary and capricious decision and is lacking substantial evidence in support, the Patent Office should be reversed 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

B. Rejection under 35 U.S.C. § 103(a) over Sheppard, Jr et al (US 6,143, 247) in view of Mian et al. (US 6,319,469) and Cathey et al. (US 5,660,993) taken further in view of Chen et al. (US 5,800,778).

1. Claims 21, 26 and 29-32

The Patent Office rejections against claims 21, 26 and 29-32 are founded on the rejection against claim 22 previously discussed and should be reversed on the same basis.

C. Rejection under 35 U.S.C. § 103(a) over Sheppard, Jr et al (US 6,143, 247) in view of Mian et al. (US 6,319,469), and Chen et al. (US 5,800,778) taken further in view of Wolfe et al. (US 5,190,879).

1. Claims 27 and 28

The Patent Office rejections against claims 27 and 28 are founded on the rejection against claim 22 previously discussed and should be reversed on the same basis.

D. Rejection under 35 U.S.C. § 103(a) over Sheppard, Jr et al (US 6,143, 247) in view of Mian et al. (US 6,319,469), and Cathey et al. (US 5,660,993) taken further in view of Cook (WO9426413).

1. Claim 39

The Patent Office rejection against claim 39 is founded on the rejection against claim 22 previously discussed and should be reversed on the same basis.

2. Claim 40

The Patent Office rejection against claim 40 is founded on the rejection against claim 22 previously discussed and should be reversed on the same basis. Additionally, the Patent Office alleges that an embodiment of the further limitation in claim 40 is disclosed by Cook. Final Office Action 05/17/06, pg. 9. This is also in error at least with regard to the scope and content analysis required under *Graham*. The cited portion of Cook is clearly and solely directed to analysis of molecules, viruses, ligands, etc. that interact with cells. Pg. 17, lines 17-33. This passage has nothing to do with the additional limitation in claim 40 directed to platform attached, non-cellular binding moieties. The pending Patent Office rejection thus lacks substantial evidence to support the conclusion that the claimed subject matter is obvious. Because the Patent Office rejection against the claims constitutes an arbitrary and capricious decision and is lacking substantial evidence in support, the Patent Office should be reversed. 5 U.S.C. § 706(2)(A) & (E) (Administrative Procedures Act).

VIII. CLAIMS

A copy of the claims involved in the present appeal is attached hereto as Appendix A. As indicated above, the claims in Appendix A do include the amendments filed by Applicant on May 17, 2006.

IX. EVIDENCE

No evidence pursuant to §§ 1.130, 1.131, or 1.132 or entered by or relied upon by the examiner is being submitted.

X. RELATED PROCEEDINGS

No related proceedings are referenced in II. above, or copies of decisions in related proceedings are not provided, hence no Appendix is included.

Applicant believes no additional fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 06-2375, under Order No. HO-P02190US0 from which the undersigned is authorized to draw.

Dated: December 14, 2006

Respectfully submitted,

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APPENDIX A

Claims Involved in the Appeal of Application Serial No. 10/650,412

21. The apparatus of claim 22 further comprising means, incorporated in said cell growth chamber, for cell growth, wherein one or more components of the apparatus are constructed of a gas permeable film or membrane such that CO₂-buffered media can be used in the cell growth chamber and oxygen may permeate to the cells for their metabolism during growth.

22. An apparatus microfabricated for performing cell growth and/or cell based assays in a liquid medium, said apparatus comprising:

a) a base plate supporting a plurality of micro-channel elements, each comprising a cell growth chamber, an inlet channel, and an outlet channel;

b) a cover plate positioned over said base plate said cover plate extending over said elements so as to define said chambers and channels; and

c) a hydrophobic valve in at least one of said chambers or said channels that is defined by positioning said cover plate over said base plate, wherein said valve comprises a localized region of hydrophobicity within said chamber or said channel.

23. The apparatus of claim 22 further comprising a suspension of cells to be grown in each of said cell growth chambers.

24. The apparatus of claim 23, wherein said cells require attachment to said cell growth chambers for growth.

25. The apparatus of claim 22, wherein said base plate comprises a rotatable disc which is microfabricated to provide a sample introduction port located towards the center of the disc and connected to an annular sample reservoir, and wherein said micro-channel elements are radially dispersed on said disc with their respective input channels connected to receive sample from said reservoir.

26. The apparatus of claim 22, wherein said cover plate is fabricated from a gas permeable plastic material.

27. The apparatus of claim 26, wherein the plastic material is a silicone polymer, polyurethane or polytetrafluoroethylene.

28. The apparatus of claim 27, wherein the silicone polymer is polydimethylsiloxane.

29. The apparatus of claim 21, wherein said means for cell growth comprises at least a portion of a surface of said cell growth chamber that is treated to allow for cell attachment.

30. The apparatus of claim 29, wherein said surface is negatively charged surface.

31. The apparatus of claim 29, wherein said surface comprises a coating of polylysine, collagen or fibronectin.

32. The apparatus of claim 21, wherein said means for cell growth comprises one or more microcarrier beads located in said cell growth chamber, wherein each of said microcarrier beads provides for cell attachment.

33. The apparatus of claim 22, wherein said cell growth chamber comprises raised moulded features disposed on the base portion of said cell growth chamber to form pillars.

34. The apparatus of claim 22, wherein the cross-sectional area of said inlet channel is greater than that of said outlet channel.

35. The apparatus of claim 34, wherein the cross-sectional area of said outlet channel is between 0.99 and 0.01 times that of said inlet channel.

36. The apparatus of claim 22, wherein at least some of said micro-channel elements each comprises one or more assay chambers for performing assays involving cellular constituents and connected in line between said cell growth chamber and said outlet channel.

37. The apparatus of claim 36, wherein each assay chamber is connected to each other and to said cell growth chamber by an intermediate channel in the order of: inlet channel, cell growth chamber, intermediate channel, assay chamber, outlet channel, and wherein the cross-sectional areas of the respective channels reduce progressively from the inlet channel to the outlet channel.

38. The apparatus of claim 37, wherein the cross-sectional area of each intermediate channel and the outlet channel is between 0.99 and 0.01 times that of the immediately preceding upstream channel.

39. The apparatus of claim 37, wherein there is provided in or on an interior surface of one or more of said chambers a layer comprising a scintillant substance.

40. The apparatus of claim 39, wherein the layer comprising a scintillant substance comprises a binding moiety bound thereto, said binding moiety being a member of a specific binding pair selected from the group consisting of biotin, streptavidin, protein A, antibodies, lectins, hormone-receptors, nucleic acid probes, and DNA-binding proteins.